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1071-8011-110

MONARCH INSTRUMENT

Instruction Manual

Monarch 110

Autoranging Digital Multimeter

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Safeguards and Precautions

1. **Read and follow all instructions in this manual carefully, and retain this manual for future reference.**
2. **Do not use this instrument in any manner inconsistent with these operating instructions or under any conditions that exceed the environmental specifications stated.**
3. **Ensure that the meter and test leads are in good condition with no visible signs of damage before use.**
4. **Ensure the test leads are installed in the proper connectors for the measurement to be made.**
5. **Ensure the Function Selector switch is in the correct position for the measurement to be made.**
6. **Do not, under any circustances, exceed the maximum ratings of this instrument.**
7. **Do not exceed the rated voltage between any input jack and ground.**
8. **Do not measure resistance or continuity in a circuit or test diodes while power is applied to that circuit.**
9. **Do not connect the test leads to a voltage source when the test leads are connected to the µA/mA or 10A input jacks.**
10. **Exercise extreme caution when working with voltages above 60 Vdc or 30 Vac. Such voltages pose a shock hazard.**
11. **Keep fingers behind the finger guards on the test leads when making measurements.**
12. **To avoid false readings, replace the batteries immediately when the low battery indication appears.**
13. **With exception of replacing the batteries or fuses, this instrument is not user serviceable. For technical assistance, contact the sales organization from which you purchased the product or Monarch Instrument directly.**

LIMITED WARRANTY

SELLER warrants hardware products to be free from any defect in materials or workmanship for a period of one (1) year from date of shipment to BUYER. SELLER's entire liability and BUYER's sole and exclusive remedy resulting from any defect in workmanship or material in the hardware product covered by this limited warranty shall be limited to and fully discharged by the SELLER's option of replacement or repair of such item without charge. The limited warranty provided in this clause is in lieu of all other warranties, expressed or implied, arising by law or otherwise. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED. This limited warranty shall not be modified except by an arrangement signed by both parties specifically referencing this clause.

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IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL, OR PUNITIVE LOSSES OR DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSSES OR DAMAGES FOR ANY LOST PROFITS OR LOST DATA) AS THE RESULT OF ANY BREACH OR DEFAULT BY SELLER WITH RESPECT TO THE HARDWARE OR SOFTWARE, EVEN IF SELLER HAS BEEN ADVISED OR MADE AWARE OF THE POSSIBILITY OF ANY SUCH LOSSES OR DAMAGES AND REGARDLESS OF WHETHER THE CLAIM IS BASED ON CONTRACT, TORT, STRICT LIABILITY, OR OTHER THEORY OF LIABILITY.

This limited warranty does not extend or apply to consumables (including, but not limited to, lamps and batteries, if applicable) or equipment, instruments or accessories which are warranted separately by the original manufacturer of these items.

DECLARATION OF CONFORMITY

Monarch Instrument
Division of Monarch International Inc.
15 Columbia Drive, Amherst NH 03031 USA

declares that the product:

Name: Handheld Multimeter
Model: Monarch 110

to which this declaration relates is in conformity with the following standards:

EMC: EN55011/1991
EN50082-1/1992 / IEC 801 Series

and therefore conforms in accordance with 89/336/EEC-EMC Directive. The testing of this product was performed by GesTek EMC Lab. in January of 1999. (Ref. No. 98B006E).

8th January 1999
Importer (Amherst,NH)

Alan Woolfson, VP Engineering (Authorized Signature)

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1.0 Introduction:

This instrument is a compact autoranging digital multimeter capable of measuring AC voltage and current, DC voltage and current, resistance, continuity and frequency. It is also equipped with a diode testing feature. The instrument complies with IEC 1010-1 CAT II.

2.0 Specifications:

AC Voltage (Autoranging):

Range	Resolution	Accuracy		Input Impedance	Overload Protection
		45Hz~400Hz	400Hz~1KHz		
400mV	0.1mV	1%+5 (45Hz~100Hz)		200M Ω	1100Vpeak
4V	1mV	1%+4	1.5%+4	11M Ω	1100Vpeak
40V	10mV	1%+4	1.2%+4	10M Ω	1100Vpeak
400V	100mV	1%+4	1.2%+4	10M Ω	1100Vpeak
600V	1V	1%+4	1.2%+4	10M Ω	1100Vpeak

AC Current (uA and mA - Autoranging):

Range	Resolution	Accuracy		Burden Voltage	Overload Protection
		45Hz~500Hz	500Hz~1KHz		
400uA	0.1uA	1.3%+5	1.6%+5	<0.25Vrms	0.5A / 250V Fast Blow Fuse
4000uA	1uA	1.3%+5	1.6%+5	<1Vrms	0.5A / 250V Fast Blow Fuse
40mA	10uA	1.3%+5	1.6%+5	<0.25Vrms	0.5A / 250V Fast Blow Fuse
400mA	100uA	1.3%+5	1.6%+5	<1.5Vrms	0.5A / 250V Fast Blow Fuse
10A	10mA	1.5%+5	1.8%+5	<0.35Vrms	10A / 250V Fast Blow Fuse

DC Voltage (Autoranging):

Range	Resolution	Accuracy	Input Impedance	Overload Protection
400mV	0.1mV	0.5%+2	200M Ω	1100Vpeak
4V	1mV	0.5%+2	11M Ω	1100Vpeak
40V	10mV	0.5%+2	10M Ω	1100Vpeak
400V	100mV	0.5%+2	10M Ω	1100Vpeak
600V	1V	0.8%+2	10M Ω	1100Vpeak

NOTES

NOTES

DC Current (uA and mA - Autoranging):

Range	Resolution	Accuracy	Burden Voltage	Overload Protection
400uA	0.1uA	1%+2	<0.25V	0.5A / 250V Fast Blow Fuse
4000uA	1uA	1%+2	<1V	0.5A / 250V Fast Blow Fuse
40mA	10uA	1%+2	<0.25V	0.5A / 250V Fast Blow Fuse
400mA	100uA	1%+2	<1.5V	0.5A / 250V Fast Blow Fuse
10A	10mA	1.2%+2	0.35V	10A / 250V Fast Blow Fuse

Resistance (Autoranging):

Range	Resolution	Accuracy	Test Voltage	Overload Protection
400 Ω	0.1 Ω	0.75%+2	<1.5VDC	600Vrms
4K Ω	1 Ω	0.75%+2	<1.5VDC	600Vrms
40K Ω	10 Ω	0.75%+2	<1.5VDC	600Vrms
400K Ω	100 Ω	0.75%+2	<1.5VDC	600Vrms
4M Ω	1K Ω	0.75%+2	<1.5VDC	600Vrms
40M Ω	10K Ω	1.2%+3	<1.5VDC	600Vrms

Continuity Beeper:

Range	Active Range	Test Voltage	Overload Protection
	Under 40 Ω	<1.5V	600Vrms

Diode Tester:

Range	Resolution	Accuracy	Test Current	Test Voltage	Overload Protection
	1mV	1%+ 2	<1mA	<3.2V	600Vrms

Frequency (Autoranging):

Range	Resolution	Accuracy	Sensitivity	Overload Protection
4 KHz	1Hz	0.1%+1	<300mVpp	600Vrms
40KHz	10Hz	0.1%+1	<300mVpp	600Vrms
400KHz	100Hz	0.1%+1	<300mVpp	600Vrms
4MHz	1KHz	0.1%+1	<3Vpp	600Vrms
40MHz	10KHz	0.1%+1	<3Vpp	600Vrms

Accuracy specification: ± ([…% of reading] + [… number of least significant digits]) at 18°C to 28°C (64°F to 82°F) at less than 80% RH
Temperature coefficient: 0.1 x Specified Accuracy/°C
Electromagnetic compatibility:
Vac and Aac only: RF field = 3V/m
Total accuracy: Specified accuracy + 2% of range
Digital display: 4000 counts
Sampling rate: Twice per second
Analog display: 42 segments
Sampling rate: 20 times per second
Overrange indication: Displays 'OL' when value exceeds range selected
Auto Power Off: 30 minutes after last operation
Power requirement: Two 1.5V AAA batteries
Battery life: 500 hours typical. Low battery indication.
Safety: 600V CAT II, Regulation EN61010: Part 1:1993
Operating conditions:

- Operating Temperature and Humidity: 0°C - 40°C (32°F - 104°F) Below 80% RH Non-condensing
- Storage Temperature and Humidity: -10°C - 60°C (14°F - 140°F) Below 70% RH Non-condensing
- Installation category II
- Pollution Degree 2
- Indoor use only
- Altitude up to 2000 meters (6500 feet)

Dimensions: 150×72×35mm (5.9×2.8×1.4 in)
Weight: Approx. 220g (7.8 oz)
Accessories: Test Leads, Spare Fuse (0.5A/250V), Batteries, Instruction Manual

7.0 Service and Maintenance

7.1 Service and Repair
Other than replacing the batteries and/or fuses, this instrument is NOT user serviceable. Consult qualified service and repair personnel for internal servicing.

7.2 Maintenance
Periodic maintenance is limited to cleaning of the external case with a damp cloth and mild detergent. Do not use harsh abrasives or solvents in cleaning this instrument.

6.0 Replacing Batteries and/or Fuses:

WARNING

To prevent electrical hazard or shock, turn multimeter off and disconnect test leads before removing back cover.

6.1 Replacing Batteries

To replace batteries, set the Function Selector switch to OFF and disconnect test leads. Remove the three screws on the rear of the instrument and remove the rear cover. Replace batteries, being sure to observe battery polarity as shown below. Replace rear cover before reconnecting or using the instrument.

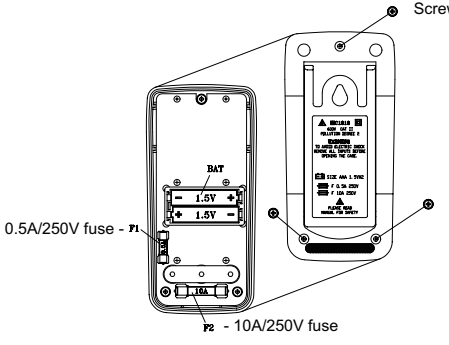
6.2 Replacing Fuses

To replace either or both fuses, set the Function Selector switch to OFF and disconnect test leads. Remove the three screws on the rear of the instrument and remove the rear cover. Replace the appropriate fuse(s) with an exact replacement. F1 is a 0.5A/250V Fast Blow fuse. F2 is a 10A/250V Fast Blow fuse. Replace rear cover before reconnecting or using the instrument.

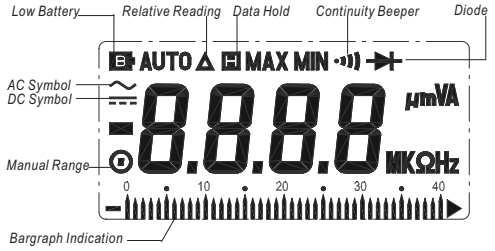
WARNING

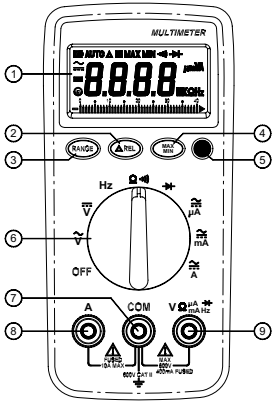
For safety, use exact replacements:

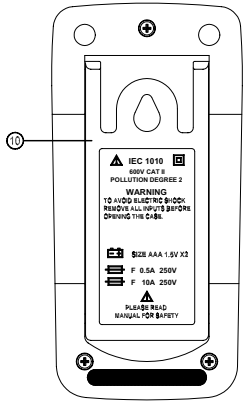
F1: 0.5A/250V 5ϕ × 20mm Fast Blow fuse
F2: 10A/250V 6.3 ϕ × 32mm Fast Blow fuse



3.0 Symbol Definitions and Feature Locations:







1) LCD display
2) Relative button
3) Autorange – Manual button
4) MAX/MIN button
5) AC/DC Current select and •)) Ω select button
6) Function selector switch
7) Common input connection
8) 10A input connection
9) **V, Ω, µA, mA, Hz,** ⊣▷⊢ connection
10) Tilt stand

4.0 Control Functions:

4.1 Function Selector Rotary Switch

The rotary switch turns power on to the instrument and selects the function to be measured. The functions available and their specifications are detailed in Section 2.0.

4.2 Range Selection

In all functions except ⟶| (Diode Test) and **A** (AC or DC Current), the instrument powers on in the Autoranging mode and the **AUTO** symbol appears in the display. To select a range manually, press the **'Range'** button. The Manual Range symbol will appear in the display, and the instrument will then be locked in the range selected. When in the Manual mode, each successive press of the **'Range'** button increases the measurement range. Range selection loops back to the lowest range when advanced from the highest range. To exit the Manual mode, press and hold the **'Range'** button for one second or rotate the Function Selector switch to a different measurement function, and the instrument returns to the Autoranging mode.

4.3 Relative Operation

Pressing the △**REL** button zeroes the display and internally stores the present reading as a reference for subsequent measurements. The main display now shows the difference between the stored value and the new reading. Press and hold the △**REL** for one second to exit the Relative mode.

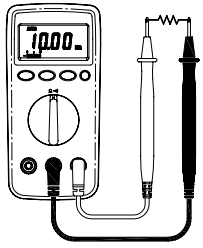
4.4 MAX/MIN Operation

Press the **MAX MIN** button to enter the MAX/MIN mode. In this mode, both the maximum and minimum values are simultaneously retained in memory and updated with every new data sample. The instrument first enters the MAX mode, and the MAX symbol and value are both displayed. Pressing **MAX MIN** again advances the display to the MIN symbol and value. The next press of the **MAX MIN** button will cause both the MAX and MIN symbols to flash. This indicates that the maximum and minimum values have been updated in memory and the displayed

5.6 Diode Tests

WARNING!

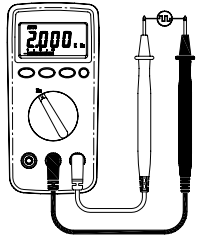
Before making any in-circuit measurements, remove power from the circuit being tested and discharge all capacitors in the circuit.



1. Connect the red test lead to the '⟶|' jack and the black test lead to the **'COM'** jack.
2. Set the Function Selector switch to the ⟶| range.
3. Remove power from the circuit being tested and discharge all capacitors in the circuit.
4. Connect the red test lead to the anode side and the black test lead to the cathode side of the diode being tested.
5. Read the Forward Voltage (V_f) on the instrument display.

Note: If the polarity of the test leads is reversed, the display will read '*OL*'**.** This can be used to determine the anode and cathode terminals of a diode.

5.7 Frequency Measurements



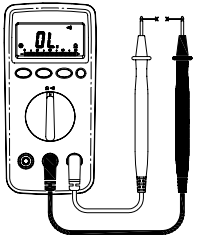
1. Connect the red test lead to the **'Hz'** jack and the black test lead to the **'COM'** jack.
2. Set the Function Selector switch to the **Hz** range.
3. Connect the test leads in parallel with the circuit being measured.
4. Read the frequency on the instrument display.

5.5 Continuity Measurements

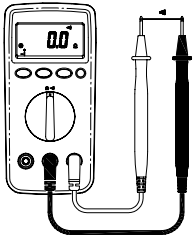
WARNING

Before making any in-circuit measurements, remove power from the circuit being tested and discharge all capacitors in the circuit.

1. Connect the red test lead to the 'Ω' jack and the black test lead to the 'COM' jack.
2. Set the Function Selector switch to the Ω range and press the blue button to select the function.
3. Remove power from the circuit being tested and discharge all capacitors in the circuit.
4. Connect the test leads to the portion of the circuit to be measured.
5. When the impedance of the circuit between the test leads is less than 40 ohms, the instrument will sound a continuous 2kHz tone.



Open circuit



Short circuit

Note: *A Continuity test may be used to determine either Open or Short circuit conditions.*

reading is the present value. Each successive press of the MAX MIN button circulates the display mode among these options.
To exit the MAX/MIN mode, press and hold the **MAX MIN** button for one second.

4.5 Auto Power Off

To conserve battery power, the instrument will sound a warning tone and automatically shut off 30 minutes after the last switch or button operation.

4.6 Low Battery Condition

When the battery voltage is at or below the minimum for proper operation, the B+ symbol will show on the LCD indicating the battery must be replaced. To replace batteries, see Section 6.1.

4.7 Fuse Protection

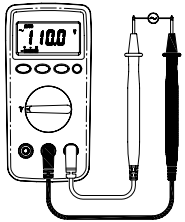
To protect the instrument from excessive input signal levels, the inputs are protected with two fast blow fuses. All inputs except the **A** (AC or DC Current) input are protected with a 0.5A/250V fuse. The **A** input is protected with a 10A/250V fuse. To replace fuses, see Section 6.2.

5.0 Operating Instructions:

5.1 AC Voltage Measurements

WARNING

Maximum Input Voltage is 600VAC. To avoid electrical shock hazard and/or damage to this instrument, do not attempt to make any voltage measurement that may exceed this limit.

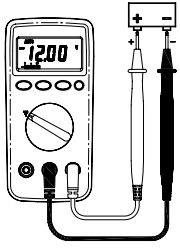


1. Connect the red test lead to the 'V' jack and the black test lead to the 'COM' jack.
2. Set the Function Selector switch to the **V~** range.
3. Connect the test leads in parallel with the circuit being measured.
4. Read the measured voltage on the instrument display.

5.2 DC Voltage Measurements

WARNING

Maximum Input Voltage is 600VDC. To avoid electrical shock hazard and/or damage to this instrument, do not attempt to make any voltage measurement that may exceed this limit.



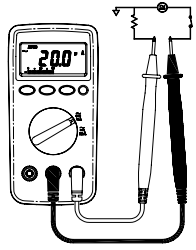
1. Connect the red test lead to the '**V**' jack and the black test lead to the '**COM**' jack.
2. Set the Function Selector switch to the **V⎓** range.
3. Connect the test leads in parallel with the circuit being measured.
4. Read the measured voltage on the instrument display.

5.3 AC/DC Current Measurements

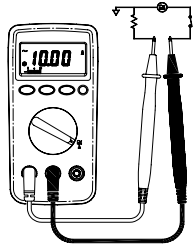
WARNING

To avoid injury, do not attempt a current measurement if the open circuit voltage exceeds the rated voltage of the meter.

1. If the current to be measured is unknown, connect the red test lead to the '**A**' jack. If it is known or has been determined that the current is 400mA or less, connect the red lead to the '**µA/mA**' jack. Connect the black test lead to the '**COM**' jack.
2. Set the Function Selector switch to the current range corresponding to the jack being used and press the blue button to select AC or DC.
3. Remove power from the circuit to be measured and connect the instrument in series with this circuit. Connect the black lead to the negative (-) side and the red lead on the positive (+) side being measured.
4. Apply power to the circuit and read the measured current on the instrument display.



uA or mA measurement

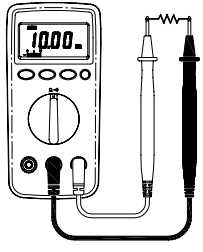


Amp measurement

5.4 Resistance Measurements

WARNING

Before making any in-circuit measurements, remove power from the circuit being tested and discharge all capacitors in the circuit.



1. Connect the red test lead the to '**Ω**' jack and the black test lead to the '**COM**' jack.
2. Set the Function Selector switch to the **Ω•))** range and press the blue button to select the **Ω** function.
3. Remove power from the circuit being tested and discharge all capacitors in the circuit.
4. Connect the test leads in parallel with the circuit to be measured and read the measured resistance on the instrument display.